

**A SHORT REVIEW
of the
SPANISH POWER SITUATION**

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1900 - 1935 Spanish pattern followed that of other European countries with similar economic development.

From 1935 to 1950 there was a severe disruption of the previous gradual and natural increase of production capacity; this was caused by three years of civil war from 1936 to 1939 and an extremely slow recovery thereafter.

Up to 1943 production covered demand of the market; but thereafter economic development in other directions so increased demand that electric production fell far behind demand.

Exceptionally severe shortages occurred in 1945 and 1949 due to droughts which affected the predominantly hydro-electric production facilities. Some of the zones were particularly affected because there was no national power grid connecting all the zones. Furthermore the emphasis on hydro rather than steam production facilities increased the shortages due to the drought.

According to Spanish estimates the ideal situation would be of a total power supply of 75% hydro and 25% steam, whereas the situation as it exists bears today a relationship closer to 90% hydro and 10% steam.

The thermal production of electric power is further handicapped by the ~~xxx~~ fact that where special heavy demands are made on this type of power

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plants they are unable to get coal except from imports - for example in 1949 the government was forced to import 2,000,000 tons of coal which had to come from exchange allotments of other industries and upset expected trade balances.

Coal is plentiful in Spain (estimated reserves - 8 billion tons). However mining and transport facilities are so hopelessly obsolete that the necessary increase in production is impossible as the situation exists at present.

At present supply of electric power is estimated still to be short of demand. The amount of shortage will be governed by the rainfall and available quantities of water stored.

The main transmission lines are being built for 220 KV although the great part of existing lines is 138 KV and 110 KV. This program is hopelessly behind due to lack of aluminum, copper, and steel. Of course for this reason transformer production is in a similar situation. Furthermore, what available materials exist are used to build power plants.

Spanish Industry can now produce hydro generators up to 10,000 KVA. Over this it joins with foreign firms by importing rotors regulators and other precision components. No steam turbine generators are produced at all -- they are imported. Boilers are built only up to 50 metric tons/hour and maximum pressure 40 kilogram/square centimeter but no feeder pumps or controls are made.

Transformers can be built up to 50,000 KVA and 138 KV., covering total Spanish requirement -- if raw materials are available.

Control and measuring devices up to 60 KV are produced - anything above must be imported. Line material except insulators are domestically produced.

To achieve present goal of power production imports for power plants above what can be produced nationally are estimated at 60 \$/KW for hydro and 100 \$/KW for steam. In addition, would be the cost of necessary controls, breakers, relays, and measuring devices for sub-stations.

In 1951 the power industries were short over 200 large breakers and the shortage for insulators was estimated at 200,000 per year. There was an estimated shortage of 2,000 tons of aluminum per year and 5,000 tons of copper per year for cables.

The power industry is cognizant of the fact that what takes four or five years for them to accomplish by utilizing domestic means could be done in one year if Spain would have been included in Marshall Plan which of course would change immediately the entire situation.

According to existing plans of the power industry they would require \$20,000,000. per year to cover necessary imports of machinery and equipment. These needs have been partially covered by the government by the granting of foreign exchange in producing countries where available funds existed.

Except for a very few exceptions the whole Spanish power industry is privately owned.

The Spanish potential of hydro power production is estimated at 30 billion KWH annually. A great part of this potential is in the northeastern part of Spain and could serve for power export to France. The Spanish seasonal rainfall occurs at a time when the French hydro plants in this area are affected by shortages of water -- and of course the reverse applies to the time when the high supply of the French plants corresponds to shortages in Spanish plants which accounts for the export to France of 15 million KWH in 1951 and the import from France of 19 million KWH in the same year.

According to DEEC Report in Europe, 2,800,000 KW could be built to produce annually 7,700 million KWH at an investment of 300\$/KW and production cost of 0.07 \$/KWH, estimated in 1948 comparable Spanish facilities would be much cheaper.

RESUME:

1. Normal increase in power demand is estimated at 750 million KWH per year.
2. Facilities of 250,000. KW per year must be built to fill this minimum requirement.
3. Power restrictions caused by drought and lack of steam facilities are damaging entire Spanish economy.

4. Spanish production facilities cannot cope with requirements of the power industry.
5. Annually \$20,000,000 in imports is needed to supplement Spanish production to cover necessary power expansion program.
6. Spanish power industry is ~~not~~ privately owned.
7. Spain could be an important member of the European power exchange.

SPAIN

Table I

Installed Capacity
(capacity in thousands of Kw)

<u>YEAR</u>	<u>THERMAL</u>	<u>HYDRO</u>	<u>TOTAL</u>
1931	315	798	1.113
1935	368	1.063	1.431
1939	344	1.169	1.513
1943	385	1.225	1.610
1945	387	1.310	1.697
1948	460	1.560	2.020
1949	588	1.680	2.268
1950	614	1.699	2.313
1951	650	1.770	2.420

SPAIN

Table II

Power Production in Millions of KWH

<u>YEAR</u>	<u>THERMAL</u>	<u>HYDRO</u>	<u>TOTAL</u>
1931	300	2.382	2.682
1935	279	2.993	3.272
1939	267	2.844	3.111
1943	433	4.385	4.818
1945	993	3.243	4.236
1948	939	5.226	6.165
1949	1.603	4.026	5.629
1950	1.875	5.275	7.150
1951	1.500	7.100	8.600

SPAIN

Table III

Utilized Hours of the Installed Capacity

<u>YEAR</u>	<u>THERMAL</u>	<u>HYDRO</u>	<u>TOTAL</u>
1931	952	2.985	2.410
1935	755	2.810	2.285
1939	776	2.433	2.056
1943	1.125	3.580	3.000
1945	2.565	2.480	2.500
1948	2.040	3.350	3.000
1949	2.725	2.400	2.480
1950	3.055	3.105	3.095

Table IVComparison with Some Other European Countries

	<u>Specific Consumption in KWH per Inhabitant in 1951</u>
SPAIN	310
AUSTRIA	940
BELGIUM	1.110
FINLAND	1.140
FRANCE	
WESTERN GERMANY	920
GREAT BRITAIN	1.430
HUNGARY	360
ITALY	630
NETHERLANDS	790
NORWAY	5.370
PORTUGAL	120
SWEDEN	2.750
SWITZERLAND	2.480
TURKEY	40
YUGOSLAVIA	160

Table V.S P A I N

Miscellaneous Data

Planned Development of Power Resources in the period 1952-1955
 Thermal...250,000 KW Hydro...1,500,000 KW

Price increase for electric power from 1938 to 1951.....30%

Transmission lines above 100 KV in Kilometers in 1951

220 KV...533 130 KV...2,623 110 KV...1,448

Coal production.....	11.3 millions metric tons/yearly	1951
Brown coal, lignite "	1.5 " " "	1951
coke "	1.15 " " "	1950
Manufactured Gas "	284. million cubic meters	1951

Table VI.

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	Area in thousands of square Kilometers	Population in 1950 in millions	Persons per square Kilometer	KWh yearly Millions *	Solid Solid fuel reserve in millions of tons Coal	Brown coal
North-Western	49.70	5.	101	4,300	5,800	
North-Central	93.80	3.2	34	2,450	581	
North-Eastern	98.10	5.1	52	17,350		767
Central	114.	5.	44	2,150	90	
Southern	87.30	5.9	66	2,300		
South-Eastern	49.50	3.6	73	2,950		
<u>S P A I N</u>	492.40	27.8	56	31,500	8,000	767

* Estimated Hydropotential economically exploitable

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Power Consumption in 1950

<u>Available for consumption in 1950.....</u>	<u>6,815,000,000 Kwh</u>
Traction.....	439,000,000 Kwh
Electrochemistry, metallurgy..	614,000,000 "
Other Industries.....	2,856,000,000 "
Public & Private Lighting.....	<u>1,319,000,000 "</u>
	5,228,000,000 Kwh
Lost in transmission and transformers.....	<u>1,587,000,000 Kwh</u>
	6,815,000,000 Kwh

S P A I NThe 6 Zones of Spain according Power-market (by Provinces)

Zona Noroeste (Northeast Zone)	La Coruna, Lugo, Pontevedra, Orense, Asturias and Santander
Zona Centro-Norte (Nord-Central Zone)	León, Zamora, Salamanca, Cáceres, Valladolid, Palencia, Burgos, Segovia, Logrono, Vizcaya, Guipúzcoa, Alava, Navarra, and a part of Badajoz
(Zona Aragonesa (Aragon Zone)	Zaragoza, and a part of Huesca and Teruel
Zona Catalana (Catalan Zone)	Barcelona, Tarragona, Gerona, Llerida, and a part of Huesca
Zona Centro-Levante (Central-Levante Zone)	Toledo, Madrid, Segovia, Guadalajara, Avila, Cuenca, Castellón de la Plana, Valencia, Alicante, Albacete, Murcia, and a part of Ciudad Real and Teruel
Zona Andaluza (Andaluz Zone)	Huelva, Cádiz, Sevilla, Córdoba, Málaga, Granada, Jaén, Almeria, and a part of Badajoz and Ciudad Real